Calculating control threshold values using native biodiversity

An example using *Pereskia aculeata* (Cactaceae) in South Africa

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Pereskia aculeata

• Primitive, creeping cactus
• Native in Central and South America
• Declared weed (1979) in South Africa
• Often invades pristine habitats
• Considered a threat to native biodiversity
• Control of *Pereskia aculeata* is justified and a biological control programme has been initiated.

• How will we evaluate the success of this biological control programme?
Measuring success in weed biological control

- Measurable goals determined prior to implementation of the control strategy
- Evaluation of success
  - Biological control does not eradicate the weed
  - Expectations of biological control are often too high
Parameters to measure success

- Agent establishment, agent population
- Damage to the weed
- Weed population
- Reduction in the weed’s impact
Return of native biodiversity

- *Pereskia aculeata* is considered a weed because it reduces native biodiversity
- The return in native biodiversity after control should be measured to quantify success
- But this must be done prior to control
Methods

• 5 X 35m transects
• 0.5x0.5x1.0 (0.25m³) quadrats selected randomly
• Plant species and % cover recorded
• +/- 120 samples per site
• Density *P. aculeata*
• Native plant diversity
  – Species richness
  – Shannon H
  – Simpson’s D
No significant differences in the relationships between Species Richness and *Pereskia aculeata* density between sites (Homogeneity of Slopes test, $F=0.405$, $p=0.943$)
Species richness

Shannon H diversity

Simpson’s D diversity

Pereskia aculeata density

Mean species richness

Pereskia aculeata density (%)
Mean Species Richness

Complete control
Reduction in weed density so native biodiversity is not different from weed densities of zero

Substantial control
Reduction in weed density and an associated increase in native biodiversity

Partial control
Reduction in weed density but no associated increase in native biodiversity

Pereskia aculeata density

Partial control
Reduction in weed density but no associated increase in native biodiversity
Evidence of causality

• Thresholds are calculated based on correlative data
• To prove a causal relationship the weed must be removed

*Phenrica guérini*
Conclusions

• To evaluate success in biological control measurable goals that can be determined prior to control are required
• By quantifying the relationship between weed density and native plant biodiversity threshold values can be calculated for environmentally damaging weed species
Conclusions

• Methods are simple – specialist scientists not required
• Short time scale (3 days per site)
• Threshold values can be validated or corrected after the weed is controlled in a long term post release evaluation